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## **ECODESIGN MATURITY MODEL AS A FRAMEWORK TO SUPPORT THE TRANSITION TOWARDS ISO 14.001:2015 CERTIFICATION**

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### **Abstract**

Currently, the certification standard for Environmental Management Systems (EMS) ISO 14.001:2011 is under a major revision process, regarding its structure and requirements. The current draft entails major changes related to the integration of the product life cycle perspective into business processes, such as product development and value chain. The standard is expected to be launched in late 2015 with a 3-year transition period. This paper explores the application of the Ecodesign Maturity Model (EcoM2) as a framework to support the planning and implementation of ISO 14.001:2015, based on a case study carried out in a large manufacturing company. The EcoM2 supports the identification of the gaps to be fulfilled based on the diagnosis of the current maturity profile, the definition of the activities to be carried out in a strategic roadmap deployment, and the systematic measurement of the achievements obtained over time, towards the fulfillment of requirements and improved maturity profiles.

**Keywords:** Environmental management systems, Ecodesign maturity model, Ecodesign

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## 1 INTRODUCTION

Despite the recognition that the ISO 14.001 standard can lead to improved ecodesign implementation and increased environmental performance of the developed products (Donnelly et al., 2006; Meinders and Stevels, 1997), most of the companies certified by ISO 14.001 still focus on the management and improvement of the manufacturing processes and facilities. The link between ISO 14.001 and the management of the environmental performance of products is still very limited and dependent on the auditors' interpretation of the standard (Ammenberg and Sundin, 2005).

Currently, the certification standard for Environmental Management Systems ISO 14.001 is undergoing a major revision, regarding its structure and requirements. The scope and launch of the revision was agreed in late 2011 and the revision work commenced in early 2012 (ISO, 2014a). The Draft International Standard (DIS) of the revised version of ISO 14001 was made available for national language translation in July 2014. The three-month balloting and commenting period began in the third quarter of 2014 (ISO, 2014a).

The current draft entails major changes related to the structure and content of environmental management systems (ISO, 2014b). The structure will be harmonized with the other ISO management systems, such as ISO 9001 (Quality Management System), facilitating the implementation of Integrated Management Systems (IMS). The main expected changes in the requirements for the ISO 14.001:2015 are related to the integration of environmental management within the strategic planning process; leadership commitment and responsibility assignment; emphasis on proactive initiatives to protect the environment; focus on the improvement of the environmental performance; implementation of life cycle thinking for products and services; internal and external communication; and documentation.

The DIS also reinforces the importance of expanding the scope of environmental management systems to the business and engineering processes of an organization that have significant influence on its environmental performance, from a life cycle perspective (ISO, 2014b). In this context, product development becomes an important process for ISO 14.001, especially for manufacturing companies that have active product development. Annex A of the draft clearly states that "(...) scoping is not to be used as a means to exclude activities, products, services, or facilities that have, or can have significant environmental aspects. It should be factual and representative of the organization operation and environmental management system boundaries in order not to mislead interested parties." (ISO, 2014b).

Recently, the results of the evaluation of the draft have been announced. The review process will be carried out in early 2015, based on the feedback received from the various countries. The standard is expected to be launched in the third quarter of 2015 and a three-year transition period is projected for companies to adapt to the new requirements. In order to be able to keep the ISO 14.001 certification after this period, companies need to prove compliance with the new established requirements.

In order to support companies to be ready for the transition towards the new ISO 14.001:2015, this paper explores the application of the Ecodesign Maturity Model (EcoM2) as a managerial framework to support the planning and implementation for the ISO 14.001:2015 certification, focused on the product development and related processes – and demonstrate the applicability in a case study.

We begin in the following section by describing the EcoM2 and its main elements. The methodology employed in this research is presented in section 3, and is followed by the presentation of the results in terms of the maturity profile needed to ensure certification in accordance to the ISO 14.001:2015 standard. Section 5 presents the results of the case study carried out in a large manufacturing company, which is followed by a summary and final remarks.

## 2 ECODESIGN MATURITY MODEL (ECOM2)

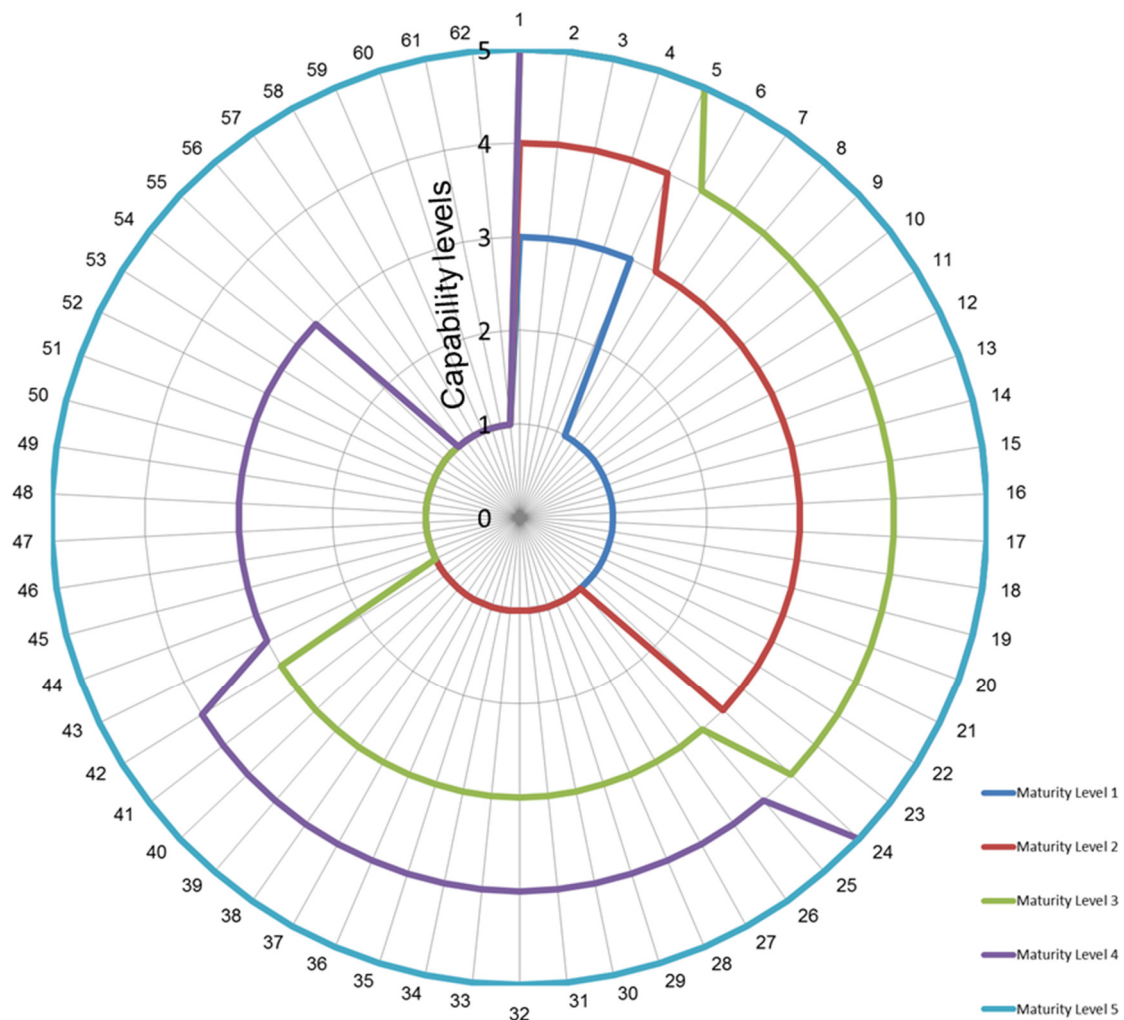
The EcoM2 is a management framework with a step-by-step approach that supports manufacturing companies<sup>1</sup> in carrying out ecodesign implementation in a consistent and systematic way (Pigosso et al., 2013). The model focuses on process improvement (product development and related processes) from a managerial perspective, i.e. on the systematic and sustained integration of environmental

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<sup>1</sup> The EcoM2 has already been applied into seven large multinational companies, from different sectors including aerospace, medical devices, toys and cosmetics.

considerations into the processes of a product development organization (Pigosso et al., 2013). It is composed of three elements: I) application method: a 6-step improvement approach that goes from the diagnosis of the current maturity profile and establishment of a strategic roadmap to the implementation and evaluation of the results (Pigosso et al., 2012); II) ecodesign practices: a comprehensive collection of more than 600 practices related to ecodesign management (62 management practices), technical issues of product design (operational practices) and associated techniques and tools (Pigosso and Rozenfeld, 2011; Pigosso et al., 2014); and III) maturity levels: a prescriptive set of successive stages for the incorporation of environmental issues into the product development and related processes, defined as a combination of evolution levels and capability levels (Pigosso et al., 2013).

The evolution levels describe a recommendation of the stages to be followed for ecodesign implementation, from the most basic levels that will create the foundation for ecodesign implementation in the company to the most advanced ones, which incorporate environment into the strategic decision making process. The capability levels qualitatively measure how well a company applies each one of the ecodesign management practices, according to five levels: incomplete (1), ad hoc (2), formalized (3), controlled (4) and improved (5). A maturity radar (Fig. 1) illustrates the ecodesign maturity levels as a combination of the evolution and capability levels.



*Figure 1: Ecodesign Maturity Radar: a graphical representation of the ecodesign maturity levels (Pigosso et al., 2013)*

The 62 ecodesign management practices are represented by codes and organized in the radar according to their evolution levels, following a clockwise direction from the first to the fifth evolution level. The capability levels (1 - 5) correspond to the axis of the radar. The standard maturity levels are represented by the coloured lines inside the radar. The maturity levels indicate the path a company

should follow for ecodesign implementation. The environmental profile of products is not considered in the definition of maturity in ecodesign (Pigosso et al., 2013) - the maturity levels are tied to the degree to which companies have institutionalized ecodesign practices.

### 3 METHODOLOGY

In order to evaluate the required maturity profile that a manufacturing company needs to have in product development, in order to be ready for a certification according to the DIS ISO 14.001:2015, a five-step methodology was followed in this research:

1. Detailed analysis of the DIS ISO 14.001:2015 and the main changes when compared to ISO 14.001:2011;
2. Identification of the new requirements of DIS ISO 14.001:2015 with focus on product development;
3. Cross-content analysis of the new ISO requirements and the 62 management practices of the EcoM2;
4. Identification of the capability level required for the application of each one of the ecodesign management practices;
5. Consolidation of the required maturity profile for certification, represented in the maturity radar.

To test the usability of the maturity profile required for DIS ISO 14.001:2015, a case study (Voss, 2009) was carried out in a large manufacturing company that currently holds ISO 14.001. The case study focused on the identification of the gap that the case company should close, if it were to be able to ensure re-certification for ISO 14.001, based on the company's current maturity profile (identified by means of a diagnosis) and the requirements of the pending revised ISO 14.001 standard, respectively.

### 4 RESULTS

The results of the first four steps described in the methodology are summarized in Table 1, which presents the requirements for ISO 14.001:2015 certification (ISO, 2014a) in terms of the capability level to be achieved for each one of the 62 management practices of the EcoM2.

The capability levels are defined as following: 1) incomplete: practice is not applied or is applied incompletely; 2) ad hoc: practice is applied in an ad hoc way, i.e. to correct a problem or to accomplish a specific task by some individuals in the company, but not yet in a formalized and systematized way; 3) formalized: the application of the practice is formalized in documented processes and the infrastructure, responsibilities and resources to support the practice are allocated ; 4) controlled: the application of the management practice is formalized and controlled, i.e. its performance is measured and monitored throughout time by using performance indicators ; 5) continuous improved: the performance of the application of the management practice is continuously improved based on the measurement and monitoring.

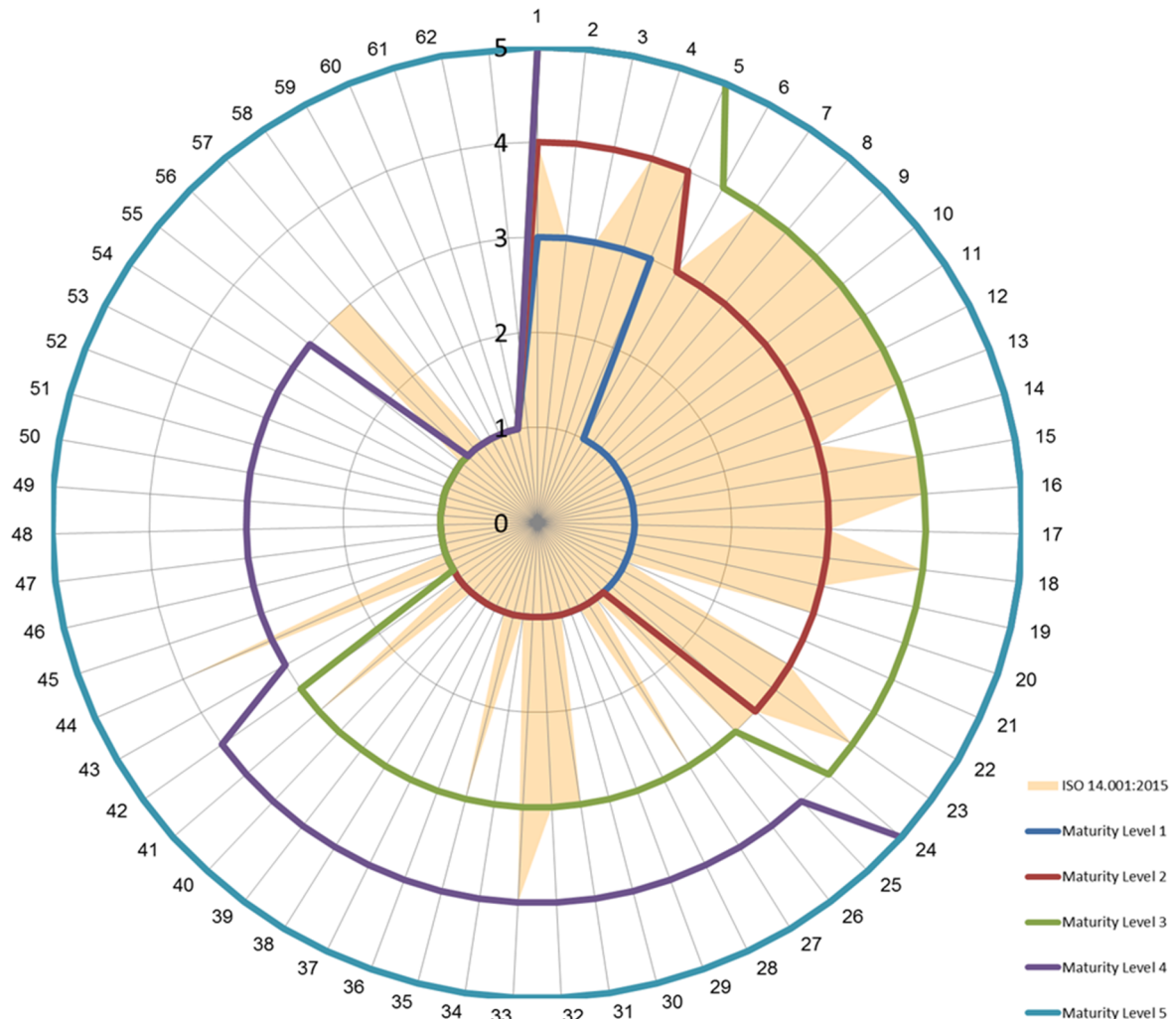
*Table 1: Required capability level for based on the ISO 14.001:2015 requirements*

Code	Management practice	Capability Level
1	Get knowledge on ecodesign at the company in order to develop products with a better environmental performance	4
2	Perform external benchmarking of the environmental performance of products and/or ecodesign best practices	3
3	Examine the relevant internal and external drivers for the development of products with a better environmental performance	3
4	Collect information about legal issues and standards related to the environmental performance of products in the countries that the company operates	4
5	Formulate and update the company environmental policy and/or strategy	4
6	Deploy and maintain environmental policy and/or strategy in the product level	3
7	Establish a prioritized program for ecodesign implementation and management	4

8	Select the relevant people from functions across the company to be involved in the ecodesign activities	4
9	Define and measure performance indicators for the environmental performance of the ecodesign program	4
10	Provide trainings and workshops to increase consciousness and awareness about the application opportunities and benefits of ecodesign	4
11	Ensure commitment, support and resources to implement ecodesign	4
12	Deploy the responsibilities and authorities among people of different areas and hierarchical levels for ecodesign implementation	4
13	Ensure appropriate communication among departments and different hierarchical levels for ecodesign during the product development process	4
14	Select and customize ecodesign methods and tools to be used during the product development and related processes according to the company's needs	3
15	Provide training for the employees involved in the product development process in the application of the ecodesign best practices and tools	4
16	Formulate, update and monitor mandatory rules and/or product requirements to comply with environmental product-related legislations and/or regulations	4
17	Implement the Life Cycle Thinking into the product development processes	3
18	Evaluate environmental performance of products during product development	4
19	Assess technological and market trends (including new customer requirements) related to the environmental performance of products	3
20	Identify customers' and stakeholders' requirements and priorities concerning the environmental performance of products	3
21	Develop and/or customize environmentally product-related guidelines to support the development of products with a better environmental performance	1
22	Consider the environmental aspects in the identification, qualification and management of suppliers	3
23	Optimize the existing production processes in order to improve the environmental performance of products during manufacturing	4
24	Consider the environmental performance of packaging and distribution processes during the product development and related processes	3
25	Make the environmental considerations a part of the daily routine of the employees involved with product development and related processes	3
26	Develop a "green" incentive scheme for the consideration of the environmental issues into product development and related processes	1
27	Integrate ecodesign into the product development and related processes standards and procedures	3
28	Measure and monitor the environmental feasibility of new development projects	1
29	Clearly define the environmental indicators and the methodology to be used during the gates (phase assessments)	1
30	Check the environmental performance of products during the phase assessments (gates)	1
31	Ensure alignment among strategic and operational dimensions concerning environmental issues in product development	3
32	Establish priorities on the environmental impacts to be minimized over the entire life cycle of the product	3
33	Clearly define the goals to improve environmental performance of the products under development	4
34	Include the environmental goals into the product target specifications	1
35	Define and measure environmental performance indicators for products according to the goals agreed	3
36	Consider the trade-offs among the environmental requirements and the traditional requirements of a product (such as quality and cost)	1
37	Identify the environmental guidelines that can be applied in product design in	1

	order to increase the environmental performance of the products	
38	Select and/or develop new manufacturing and assembly processes in a way to improve the product environmental performance during the manufacturing	1
39	Identify and/or develop new technologies that can contribute to improve the environmental performance of the developed products	1
40	Evaluate the environmental performance of technologies	1
41	Define and measure performance indicators for the environmental performance of stakeholders such as suppliers, after sales, service providers, recyclers, etc.	3
42	Communicate the environmental performance and benefits as part of the total value proposition of the product, exploring the green marketing opportunities	1
43	Clearly define the product-related environmental goals for the whole company	1
44	Conduct management reviews to evaluate the effectiveness of the environmental issues consideration in the product development and related processes	4
45	Perform functionality analysis to determine requirements for a product and find new ways to deliver the functions with a better environmental performance	1
46	Improve the interaction between product and service developments in order to explore the potential to offer solutions with a better environmental performance	1
47	Consider the environmental performance as one selection criteria for the product concept and design options	1
48	Consider and involve the total value chain for improving the environmental performance of products	1
49	Establish cooperation programs and joint goals with suppliers and partners aiming to improve the environmental performance of products	1
50	Develop the technical support processes (e.g. maintenance, change of spare parts, etc.) aiming to improve the environmental performance of the product over its entire life cycle	1
51	Define the end-of-life and reverse logistics strategies to be addressed during product development in order to improve the environmental performance of the product in the end-of-life phase	1
52	Elaborate and communicate recommendations to consumers on how to improve the environmental performance of the product during the use and end-of-life	1
53	Communicate to customer and stakeholders the improvements on the product environmental performance and consequent economic gains	1
54	Monitor the product environmental performance during use and end-of-life phases of the life cycle	1
55	Supply product development with information related to the environmental performance of materials, processes and components in the life cycle	1
56	Effectively integrate product-related environmental goals into the corporate strategy	3
57	Integrate the environmental dimension in the strategic decision making process jointly with the traditional aspects	3
58	Establish product-related vision, strategy and environmental roadmaps in the strategic level at the company	1
59	Strategically consider the product environmental performance in the company portfolio management	1
60	Develop business, product and market strategies considering the environmental trends	1
61	Incorporate product-related environmental goals into the technological strategy	1
62	Define a strategic roadmap for the development and implementation of new technologies that allows a better environmental performance over the product life cycle	1

The graphical representation of the maturity profile that a company must have in order to ensure the certification in accordance to the new requirements of ISO 14.001:2015 is presented in Figure 2. The radar is often used as a tool to communicate a company's ecodesign performance, since it provides a clear and graphical representation of the current maturity profile, showing strengths and weaknesses and enabling the identification of gaps for improvement in ecodesign application. It also allows comparisons to be made between previous and current situations so that the improvements achieved over a certain period of time can be monitored.



*Figure 2: Ecodesign Maturity Radar: a graphical representation of the requirements for ISO 14.001:2015*

The light orange area indicates the required capability levels for each one of the 62 ecodesign management practices of the EcoM2, based on the new requirements of ISO 14.001:2015 (as presented in Table 1). Overall, the requirements for certification according to the new ISO are between the second and third maturity levels, as defined by the EcoM2.

## 5 CASE STUDY

The case study that was carried out in a large and globally operating manufacturing company had the aim of testing the EcoM2 as a boundary object to support the transition towards the new ISO 14.001:2015. The case company was already ISO 14.001 certified at the time of study and had been so for more than 12 years, with its current certification covering mainly the manufacturing facilities and buildings worldwide. Most of the company's business processes, including product development, are not in the scope of the current ISO 14.001:2011 certification.



The first step in the case study was to perform a diagnosis of the current maturity profile of the company, based on the EcoM2, in order to identify which ecodesign management practices were currently being applied and with which capability. The diagnosis was performed over three weeks and was composed by three main steps: documental analysis; interviews for maturity assessment; and consolidation of the results. The main result of the diagnosis phase was the identification of the current maturity profile, with a clear indication of gaps and strengths on ecodesign implementation.

Subsequently, the required maturity profile for complying with the new requirements for ISO 14.001, as presented in Figure 2, was compared to the current maturity profile of the company, as identified in the diagnosis. Based on the comparison, a gap analysis was performed and the definition of the practices that were needed, in order to improve the capability level, was carried out.

A new maturity profile was developed, including only the practices that needed to be improved to facilitate the transition period towards the ISO 14.001:2015 certification, thus simplifying the representation of the maturity profile. The results of the gap analysis were summarized and formally presented to top management. This enabled the company management to approve the results of the gap analysis and identify the required improvements to ensure the certification; this exercise also gave a first estimate of the resources required for the transition process. On the basis of the gap analysis, the management decided to commit resources to the transition period towards ISO 14.001:2015 certification with focus on improving the maturity of product development and related processes.

The next steps, according to the EcoM2 application method (Pigosso et al., 2013), comprise the development of a strategic roadmap for the implementation of the required improvement projects, respecting the need of creating the basis in the organization, before going towards the implementation of more complex and advanced practices.

## **6 SUMMARY AND FINAL REMARKS**

This paper presented the results of a research that aimed to support companies in the transition towards ISO 14.001:2015 certification, based on the Ecodesign Maturity Model (EcoM2) – a management framework that supports companies to achieve consistent ecodesign implementation.

A cross-analysis between the new requirements for ISO 14.001:2015 and the management practices of the EcoM2 was established, resulting in the definition of the required maturity profile for ensuring certification according to the new standard. To test the applicability of using the EcoM2 as a framework to support the transition period towards the new standard, a case study was carried out in a large manufacturing company that was already certified according to the latest ISO 14.001 standard. The EcoM2 could successfully support the identification of the gaps to be closed, in order to achieve ISO 14.001:2015 certification based on the diagnosis of the current maturity profile of the company, enabling commitment from top management during the implementation period.

Advancing the implementation of the practices, the EcoM2 can also be used to support the definition of the activities to be carried out in a strategic roadmap deployment, focusing on the right order of implementation of the practices (in accordance to the maturity levels), enabling a consistent and systematic implementation. Furthermore, it can also be used to systematically evaluate the status of implementation, by measuring the achievements obtained towards the fulfillment of the requirements and improved maturity profiles.

As the evaluation was performed based on the draft international standard, the requirements presented and interpreted in this research might change according to the review that is scheduled to take place in 2015. After publication of the final standard, the results obtained in this research must be reviewed and adapted according to the final requirements of ISO 14.001:2015.

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